# SCIENCE

NEW SERIES
VOL. 74, No. 1905

FRIDAY, JULY 3, 1931

SUBSCRIPTION, $6.00
SINGLE COPIES, 0.15



*Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.*

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VOL. 74 FRIDAY, JULY 3, 1931 No. 1905



SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal
Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

# RACE AND PROGRESS[1]

By Professor FRANZ BOAS

COLUMBIA UNIVERSITY

PERMIT me to call your attention to the scientific aspects of a problem that has been for a long time agitating our country and which, on account of its social and economic implications, has given rise to strong emotional reactions and has led to varied types of legislation. I refer to the problems due to the intermingling of racial types.

If we wish to reach a reasonable attitude, it is necessary to separate clearly the biological and psychological aspects from the social and economic implications of this problem. Furthermore, the social motivation of what is happening must be looked at not from the narrow point of view of our present conditions but from a wider angle.

The facts with which we are dealing are diverse. The plantation system of the south brought to our shores a large Negro population. Considerable mixture between white masters and slave women occurred during the period of slavery, so that the number of pure Negroes was dwindling continually and the colored population gradually became lighter. A certain amount of intermingling between White and Indian took place, but in the United States and Canada this has never occurred to such a degree that it became an important social phenomenon. In Mexico and many parts of Central and South America it is the most typical case of race contact and race mixture. With the development of immigration the people of eastern and southern Europe were attracted to our country and form now an important part of our population. They differ in type somewhat among themselves, although the racial contrasts are much less than those between Indians or Negroes and Whites. Through Mexican and West Indian immigration another group has come into our country, partly of South European, partly of mixed Negro

[1] Address of the president of the American Association for the Advancement of Science, Pasadena, June 15.

and mixed Indian descent. To all these must be added the East Asiatic groups, Chinese, Japanese and Filipinos, who play a particularly important rôle on the Pacific Coast.

The first point in regard to which we need clarification refers to the significance of the term race. In common parlance when we speak of a race we mean a group of people that have certain bodily and perhaps also mental characteristics in common. The Whites, with their light skin, straight or wavy hair and high nose, are a race set off clearly from the Negro with their dark skin, frizzly hair and flat nose. In regard to these traits the two races are fundamentally distinct. Not quite so definite is the distinction between East Asiatics and European types, because transitional forms do occur among normal White individuals, such as flat faces, straight black hair and eye forms resembling the East Asiatic types; and conversely European-like traits are found among East Asiatics. For Negro and White we may speak of hereditary racial traits so far as these radically distinct features are concerned. For Whites and East Asiatics the difference is not quite so absolute, because a few individuals may be found in each race for whom the racial traits do not hold good, so that in a strict sense we can not speak of absolutely valid hereditary racial traits.

This condition prevails to a much more marked extent among the different so-called races of Europe. We are accustomed to speak of a Scandinavian as tall, blonde and blue-eyed, of a South Italian as short, swarthy and dark-eyed; of a Bohemian as middle-sized, with brown or gray eyes and wide face and straight hair. We are apt to construct ideal local types which are based on our everyday experience, abstracted from a combination of forms that are most frequently seen in a given locality, and we forget that there are numerous individuals for whom this description does not hold true. It would be a rash undertaking to determine the locality in which a person is born solely from his bodily characteristics. In many cases we may be helped in such a determination by manners of wearing the hair, peculiar mannerisms of motion, and by dress, but these are not to be mistaken for essential hereditary traits. In populations of various parts of Europe many individuals may be found that may as well belong to one part of the continent as to another. There is no truth in the contention so often made that two Englishmen are more alike in bodily form than, let us say, an Englishman and a German. A greater number of forms may be duplicated in the narrower area, but similar forms may be found in all parts of the continent. There is an overlapping of bodily form between the local groups. It is not justifiable to assume that the individuals that do not fit into the ideal local type which we construct from general impressions are foreign elements in the population, that their presence is always due to intermixture with alien types. It is a fundamental characteristic of all local populations that the individuals differ among themselves, and a closer study shows that this is true of animals as well as of men. It is, therefore, not quite proper to speak in these cases of traits that are hereditary in the racial type as a whole, because too many of them occur also in other racial types. Hereditary racial traits should be shared by the whole population and set it off against others.

The matter is quite different when individuals are studied as members of their own family lines. Racial heredity implies that there must be a unity of descent, that there must have existed at one time a small number of ancestors of definite bodily form, from whom the present population has descended. It is quite impossible to reconstruct this ancestry through the study of a modern population, but the study of families extending over several generations is often possible. Whenever this study has been undertaken we find that the family lines represented in a single population differ very much among themselves. In isolated communities where the same families have intermarried for generations the differences are less than in larger communities. We may say that every racial group consists of a great many family lines which are distinct in bodily form. Some of these family lines are duplicated in neighboring territories and the more duplication exists the less is it possible to speak of fundamental racial characteristics. These conditions are so manifest in Europe that all we can do is to study the frequency of occurrence of various family lines all over the continent. The differences between the family lines belonging to each larger area are much greater than the differences between the populations as a whole.

Although it is not necessary to consider the great differences in type that occur in a population as due to mixture of different types, it is easy to see that intermingling has played an important part in the history of modern populations. Let us recall to our minds the migrations that occurred in early times in Europe, when the Kelts of Western Europe swept over Italy and eastward to Asia Minor, when the Teutonic tribes migrated from the Black Sea westward into Italy, Spain and even into North Africa; when the Slav expanded northeastward over Russia, and southward into the Balkan Peninsula; when the Moors held a large part of Spain, when Roman and Greek slaves disappeared in the general population, and when Roman colonization affected a large part of the Mediterranean area. It is interesting to note

that Spain's greatness followed the period of greatest race mixture, that its decline set in when the population became stable and immigration stopped. This might give us pause when we speak about the dangers of the intermingling of European types. What is happening in America now is the repetition on a larger scale and in a shorter time of what happened in Europe during the centuries when the people of northern Europe were not yet firmly attached to the soil.

The actual occurrence of intermingling leads us to consider what the biological effect of intermixture of different types may be. Much light has been shed on this question through the intensive study of the phenomena of heredity. It is true we are hampered in the study of heredity in man by the impossibility of experimentation, but much can be learned from observation and through the application of studies of heredity in animals and plants. One fact stands out clearly. When two individuals are mated and there is a very large number of offspring and when furthermore there is no disturbing environmental factor, then the distribution of different forms in the offspring is determined by the genetic characteristics of the parents. What may happen after thousands of generations have passed does not concern us here.

Our previous remarks regarding the characteristics of local types show that matings between individuals essentially different in genetic type must occur in even the most homogeneous population. If it could be shown, as is sometimes claimed, that the progeny of individuals of decidedly distinct proportions of the body would be what has been called disharmonic in character, this would occur with considerable frequency in every population, for we do find individuals let us say with large jaws and large teeth and those with small jaws and small teeth. If it is assumed that in the later offspring these conditions might result in a combination of small jaws and large teeth a disharmony would develop. We do not know that this actually occurs. It merely illustrates the line of reasoning. In matings between various European groups these conditions would not be materially changed, although greater differences between parents would be more frequent than in a homogeneous population.

The essential question to be answered is whether we have any evidence that would indicate that matings between individuals of different descent and different type would result in a progeny less vigorous than that of their ancestors. We have not had any opportunity to observe any degeneracy in man as clearly due to this cause. The high nobility of all parts of Europe can be shown to be of very mixed origin. French, German and Italian urban populations are derived from all the distinct European types. It would be difficult to show that any degeneracy that may exist among them is due to an evil effect of intermating. Biological degeneracy is found rather in small districts of intense inbreeding. Here again it is not so much a question of type, but of the presence of pathological conditions in the family strains, for we know of many perfectly healthy and vigorous intensely inbred communities. We find these among the Eskimos and also among many primitive tribes among whom cousin marriages are prescribed by custom.

These remarks do not touch upon the problem of the effect of intermarriages upon bodily form, health and vigor of crosses between races that are biologically more distinct than the types of Europe. It is not quite easy to give absolutely conclusive evidence in regard to this question. Judging merely on the basis of anatomical features and health conditions of mixed populations there does not seem to be any reason to assume unfavorable results, either in the first or in later generations of offspring. The mixed descendants of European and American Indians are taller and more fertile than the pureblood Indians. They are even taller than either parental race. The mixed blood Dutch and Hottentot of South Africa and the Malay mixed bloods of the Island of Kisar are in type intermediate between the two races, and do not exhibit any traits of degeneracy. The populations of the Sudan, mixtures of Mediterranean and Negro types, have always been characterized by great vigor. There is also little doubt that in eastern Russia a considerable infusion of Asiatic blood has occurred. The biological observations on our North American mulattoes do not convince us that there is any deleterious effect of race mixture so far as it is evident in anatomical form and function.

It is also necessary to remember that in varying environment human forms are not absolutely stable, and many of the anatomical traits of the body are subject to a limited amount of change according to climate and conditions of life. We have definite evidence showing changes of bodily size. The stature in European populations has increased materially since the middle of the nineteenth century. War and starvation have left their effects upon the children growing up in the second decade of our century. Proportions of the body change with occupation. The forms of the hand of the laborer and that of the musician reflect their occupations. The changes in headform that have been observed are analogous to those observed in animals under varying conditions of life, among lions born in captivity or among rats fed with different types of diet. The extent to which geographical and social environment may change

bodily form is not known, but the influences of outer conditions have to be taken into consideration when comparing different human types.

Selective processes are also at work in changing the character of a population. Differential birth-rate, mortality and migration may bring about changes in the hereditary composition of a group. The range of such changes is limited by the range of variation within the original population. The importance of selection upon the character of a population is easily overestimated. It is true enough that certain defects are transmitted by heredity, but it can not be proved that a whole population degenerates physically by the numerical increase of degenerates. These always include the physically unfit, and others, the victims of circumstances. The economic depression of our days shows clearly how easily perfectly competent individuals may be brought into conditions of abject poverty and under stresses that only the most vigorous minds can withstand successfully. Equally unjustified is the opinion that war, the struggle between national groups, is a selective process which is necessary to keep mankind on the onward march. Sir Arthur Keith, only a week ago, in his rectoral address at the University of Aberdeen is reported to have said that "Nature keeps her human orchard healthy by pruning and war is her pruning hook." I do not see how such a statement can be justified in any way. War eliminates the physically strong, war increases all the devastating scourges of mankind such as tuberculosis and genital diseases, war weakens the growing generation. History shows that energetic action of masses may be released not only by war but also by other forces. We may not share the fervor or believe in the stimulating ideals; the important point is to observe that they may arouse the same kind of energy that is released in war. Such a stimulus was the abandonment to religion in the middle ages, such is the abandonment of modern Russian youths to their ideal.

So far we have discussed the effects of heredity, environment and selection upon bodily form. We are not so much concerned with the form of the body as with its functions, for in the life of a nation the activities of the individual count rather than his appearance. There is no doubt in my mind that there is a very definite association between the biological make-up of the individual and the physiological and psychological functioning of his body. The claim that only social and other environmental conditions determine the reactions of the individual disregards the most elementary observations, like differences in heart beat, basal metabolism or gland development; and mental differences in their relation to extreme anatomical disturbances of the nervous system. There are organic reasons why individuals differ in their mental behavior.

But to acknowledge this fact does not mean that all differences of behavior can be adequately explained on a purely anatomical basis. When the human body has reached maturity, its form remains fairly stable until the changes due to increasing age set in. Under normal conditions the form and the chemical constitution of the adult body remain almost stable for a number of years. Not so with bodily functions. The conditions of life vary considerably. Our heart beat is different in sleep and in waking. It depends upon the work we are doing, the altitude in which we live, and upon many other factors. It may, therefore, well be that the same individual under different conditions will show quite different reactions. It is the same with other bodily functions. The action of our digestive tract depends upon the quality and quantity of the food we consume. In short, the physiological reactions of the body are markedly adjusted to conditions of life. Owing to this many individuals of different organic structure when exposed to the same environmental conditions will assume a certain degree of similarity of reaction.

On the whole it is much easier to find decided differences between races in bodily form than in function. It can not be claimed that the body in all races functions in an identical way, but that kind of overlapping which we observed in form is even more pronounced in function. It is quite impossible to say that, because some physical function, let us say the heart beat, has a certain measure, the individual must be White or Negro—for the same rates are found in both races. A certain basal metabolism does not show that a person is a Japanese or a White, although the averages of all the individuals in the races compared may exhibit differences. Furthermore, the particular function is so markedly modified by the demands made upon the organism that these will make the reactions of the racial groups living under the same conditions markedly alike. Every organ is capable of adjustment to a fairly wide range of conditions, and thus the conditions will determine to a great extent the kind of reaction.

What is true of physiological function is equally true of mental function. There exists an enormous amount of literature dealing with mental characteristics of races. The blonde North-Europeans, South Italians, Jews, Negroes, Indians, Chinese have been described, as though their mental characteristics were biologically determined. It is true, each population has a certain character that is expressed in its behavior, so that there is a geographical distribution of types of behavior. At the same time we have a geographical distribution of anatomical types, and

as a result we find that a selected population can be described as having a certain anatomical type and a certain kind of behavior. This, however, does not justify us in claiming that the anatomical type determines behavior. A great error is committed when we allow ourselves to draw this inference. First of all it would be necessary to prove that the correlation between bodily form and behavior is absolute, that it is valid not only for the selected spot, but for the whole population of the given type, and, conversely, that the same behavior does not occur when the types of bodily build differ. Secondly, it would have to be shown that there is an inner relation between the two phenomena.

I might illustrate this by an example taken from an entirely different field. A particular country has a specific climate and particular geological formation. In the same country is found a certain flora. Nevertheless, the character of soil and climate does not explain the composition of the flora, except in so far as it depends upon these two factors. Its composition depends upon the whole historical evolution of plant forms all over the world. The single fact of an agreement of distribution does not prove a genetic relation between the two sets of observations. Negroes in Africa have long limbs and a certain kind of mental behavior. It does not follow that the long limbs are in any way the cause of their mental behavior. The very point to be proved is assumed as proved in this kind of argumentation.

A scientific solution of this problem requires a different line of approach. Mental activities are functions of the organism. We have seen that physiological functions of the same organism may vary greatly under varying conditions. Is the case of mental reactions different? While the study of cretins and of men of genius shows that biological differences exist which limit the type of individual behavior, this has little bearing upon the masses constituting a population in which great varieties of bodily structure prevail. We have seen that the same physiological functions occur in different races with varying frequency, but that no essential qualitative differences can be established. The question must be asked whether the same conditions prevail in mental life.

If it were possible to subject two populations of different type to the same outer conditions the answer would not be difficult. The obstacle in our way lies in the impossibility of establishing sameness of conditions. Investigators differ fundamentally in their opinion in regard to the question of what constitutes sameness of conditions, and our attention must be directed, therefore, to this question.

If we could show how people of exactly the same biological composition react in different types of environment, much might be gained. It seems to me that the data of history create a strong presumption in favor of material changes of mental behavior among peoples of the same genetic composition. The free and easy English of Elizabethan times contrasts forcibly with the prudish Mid-Victorian; the Norse Viking and the modern Norwegian do not impress us as the same; the stern Roman republican and his dissolute descendant of imperial times present striking contrasts.

But we need more tangible evidence. At least in so far as intelligent reaction to simple problems of everyday life is concerned, we may bring forward a considerable amount of experimental evidence that deals with this problem. We do not need to assume that our modern intelligence tests give us a clue to absolutely biologically determined intelligence—whatever that may mean—they certainly do tell us how individuals react to simple, more or less unfamiliar, situations. At a first glance it would seem that very important racial differences are found. I refer to the many comparative tests of the intelligence of individuals of various European types and of Europeans and Negroes. North Europeans tested in our country were found as a whole decidedly superior to South Europeans, Europeans as a whole to Negroes. The question arises, what does this mean? If there is a real difference determined by race, we should find the same kind of difference between these racial types wherever they live. Professor Garth has recently collected the available evidence and reaches the conclusion that it is not possible to prove a difference due to genetic factors, that rather all the available observations may be easily explained as due to differences in social environment. It seems to me the most convincing proof of the correctness of this view has been given by Dr. Klineberg, who examined the various outstanding European types in urban and rural communities in Europe. He found that there is everywhere a marked contrast between rural and urban populations, the city giving considerably better results than the country and that furthermore the various groups do not follow by any means the same order in city and country, that the order rather depends upon social conditions, such as the excellence of the school systems and conflicts between home and school. Still more convincing are his observations on Negroes. He examined a considerable number of Negroes in southern cities who had moved to the city from rural districts. He found that the longer they lived in the city the better the results of the tests came to be, so that Negroes who had lived in the city for six years were far superior to those who had just moved to the city. He found the same result

when studying Negroes who had moved from the south to New York, an improvement with the time of residence in New York. This result agrees with Brigham's findings for Italians who had lived for varying periods in the United States. It has often been claimed, as was done in the beginning by Brigham, that such changes are due to a process of selection, that more poorly endowed individuals have migrated to the country in late years and represent the group that has just come to the city. It would be difficult to maintain this in view of the regularity with which this phenomenon reappears in every test. Still, Dr. Klineberg has also given definite evidence that selection does not account for these differences. He compared the records of the migrating groups with those who remained behind. The records collected in Nashville and Birmingham showed that there is no appreciable difference between the two groups. The migrants were even a little below those who stayed at home. He also found that the migrants who came to New York were slightly inferior to those who remained in the South.

I have given these data in some detail, because they show definitely that cultural environment is a most important factor in determining the results of the so-called intelligence tests. In fact, a careful examination of the tests shows clearly that in none of them has our cultural experience been eliminated. City life and country life, the South and the North present different types of cultural background to which we learn to adapt ourselves, and our reactions are determined by these adaptations, which are often so obscure that they can be detected only by a most intimate knowledge of the conditions of life. We have indications of such adaptations in other cases. It would seem that among the Plains Indians the experience of girls with bead work gives to them a superiority in handling tests based on form. It is highly desirable that the tests should be examined with greatest care in regard to the indirect influence of experience upon the results. I suspect strongly that such influences can always be discovered and that it will be found impossible to construct any test in which this element is so completely eliminated that we could consider the results as an expression of purely biologically determined factors.

It is much more difficult to obtain convincing results in regard to emotional reactions in different races. No satisfactory experimental method has been devised that would answer the crucial question, in how far cultural background and in how far the biological basis of personality is responsible for observed differences. There is no doubt that individuals do differ in this respect on account of their biological constitution. It is very questionable whether the same may be said of races, for in all races we find a wide range of different types of personality. All that we can say with certainty is that the cultural factor is of greatest importance and might well account for all the observed differences, although this does not preclude the possibility of biologically determined differences. The form of response of groups of the same race but culturally different is so great that it seems likely that any existing biological differences are of minor importance. I can give only a few instances. The North American Indians are reputed as stoic, as ready to endure pain and torture without a murmur. This is true in all those cases in which culture demands repression of emotion. The same Indians, when ill, give in to hopeless depression. Among closely related Indian tribes certain ones are given to ecstatic orgies, while others enjoy a life running in smooth conventional channels. The buffalo hunter was an entirely different personality from the poor Indian who has to rely on government help, or who lives on the proceeds of land rented by his White neighbors. Social workers are familiar with the subtle influence of personal relations that will differentiate the character of members of the same family. Ethnological evidence is all in favor of the assumption that hereditary racial traits are unimportant as compared to cultural conditions. As a matter of fact, ethnological studies do not concern themselves with race as a factor in cultural form. From Waitz on, through Spencer, Tylor, Bastian to our times, ethnologists have not given serious attention to race, because they find cultural forms distributed regardless of race.

I believe the present state of our knowledge justifies us in saying, that while individuals differ, biological differences between races are small. There is no reason to believe that one race is by nature so much more intelligent, endowed with great will power, or emotionally more stable than another, that the difference would materially influence its culture. Nor is there any good reason to believe that the differences between races are so great, that the descendants of mixed marriages would be inferior to their parents. Biologically there is neither good reason to object to fairly close inbreeding in healthy groups, nor to intermingling of the principal races.

I have considered so far only the biological side of the problem. In actual life we have to reckon with social settings which have a very real existence, no matter how erroneous the opinions on which they are founded. Among us race antagonism is a fact, and we should try to understand its psychological significance. For this purpose we have to consider the behavior not only of man, but also of animals. Many animals live in societies. It may be a shoal

of fish which any individuals of the same species may join, or a swarm of mosquitoes. No social tie is apparent in these groups, but there are others which we may call closed societies that do not permit any outsider to join their group. Packs of dogs and well-organized herds of higher mammals, ants and bees are examples of this kind. In all these groups there is a considerable degree of social solidarity which is expressed particularly by antagonism against any outside group. The troops of monkeys that live in a given territory will not allow another troop to come and join them. The members of a closed animal society are mutually tolerant or even helpful. They repel all outside intruders.

Conditions in primitive society are quite similar. Strict social obligations exist between the members of a tribe, but all outsiders are enemies. Primitive ethics demands self-sacrifice in the group to which the individual belongs, deadly enmity against every outsider. A closed society does not exist without antagonisms against others. Although the degree of antagonism against outsiders has decreased, closed societies continue to exist in our own civilization. The nobility formed a closed society until very recent times. Patricians and plebeians in Rome, Greeks and barbarians, the gangs of our streets, Mohammedan and infidel, and our modern nations are in this sense closed societies that can not exist without antagonisms. The principles that hold societies together vary enormously, but common to all of them are social obligations within the group, antagonisms against other parallel groups.

Race consciousness and race antipathy differ in one respect from the social groups here enumerated. While in all other human societies there is no external characteristic that helps to assign an individual to his group, here his very appearance singles him out. If the belief should prevail, as it once did, that all red-haired individuals have an undesirable character, they would at once be segregated and no red-haired individual could escape from his class no matter what his personal characteristics might be. The Negro, the East Asiatic or Malay who may at once be recognized by his bodily build is automatically placed in his class and not one of them can escape being excluded from a foreign closed group. The same happens when a group is characterized by dress imposed by circumstances, by choice, or because a dominant group prescribe for them a distinguishing symbol—like the garb of the Medieval Jews or the stripes of the convict—so that each individual, no matter what his own character may be, is at once assigned to his group and treated accordingly. If racial antipathy were based on innate human traits this would be expressed in interracial sexual aversion. The free intermingling of slave owners with their female slaves and the resulting striking decrease in the number of full-blood Negroes, the progressive development of a half-blood Indian population and the readiness of intermarriage with Indians when economic advantages may be gained by such means, show clearly that there is no biological foundation for race feeling. There is no doubt that the strangeness of an alien racial type does play an important rôle, for the ideal of beauty of the White who grows up in a purely White society is different from that of a Negro. This again is analogous to the feeling of aloofness among groups that are characterized by different dress, different mannerisms of expression of emotion, or by the ideal of bodily strength as against that of refinement of form. The student of race relations must answer the question whether in societies in which different racial types form a socially homogeneous group, a marked race consciousness develops. This question can not be answered categorically, although interracial conditions in Brazil and the disregard of racial affiliation in the relation between Mohammedans and infidels show that race consciousness may be quite insignificant.

When social divisions follow racial lines, as they do among ourselves, the degree of difference between racial forms is an important element in establishing racial groupings and in creating racial conflicts.

The actual relation is not different from that developing in other cases in which social cleavage develops. In times of intense religious feeling denominational conflicts, in times of war national conflicts take the same course. The individual is merged in his group and not rated according to his personal value.

However, nature is such that constantly new groups are formed in which each individual subordinates himself to the group. He expresses his feeling of solidarity by an idealization of his group and by an emotional desire for its perpetuation. When the groups are denominational, there is strong antagonism against marriages outside of the group. The group must be kept pure, although denomination and descent are in no way related. If the social groups are racial groups we encounter in the same way the desire for racial exogamy in order to maintain racial purity.

On this subject I take issue with Sir Arthur Keith, who in the address already referred to is reported to have said that "Race antipathy and race prejudice nature has implanted in you for her own end—the improvement of mankind through racial differentiation." I challenge him to prove that race antipathy is "implanted by nature" and not the effect of social causes which are active in every closed social group,

no matter whether it is racially heterogeneous or homogeneous. The complete lack of sexual antipathy, the weakening of race consciousness in communities in which children grow up as an almost homogeneous group; the occurrence of equally strong antipathies between denominational groups, or between social strata—as witnessed by the Roman patricians and plebeians, the Spartan Lacedaemonians and Helots, the Egyptian castes and some of the Indian castes—all these show that antipathies are social phenomena. If you will, you may call them "implanted by nature," but only in so far as man is a being living in closed social groups, leaving it entirely indetermined what these social groups may be.

No matter how weak the case for racial purity may be, we understand its social appeal in our society. While the biological reasons that are adduced may not be relevant, a stratification of society in social groups that are racial in character will always lead to racial discrimination. As in all other sharp social groupings the individual is not judged as an individual but as a member of his class. We may be reasonably certain that whenever members of different races form a single social group with strong bonds, racial prejudice and racial antagonisms will come to lose their importance. They may even disappear entirely. As long as we insist on a stratification in racial layers, we shall pay the penalty in the form of interracial struggle. Will it be better for us to continue as we have been doing, or shall we try to recognize the conditions that lead to the fundamental antagonisms that trouble us?

# OBITUARY

## SAMUEL WILSON PARR

SAMUEL WILSON PARR died at Urbana, Illinois, on May 16, following a heart attack. He was born on January 21, 1857, at Granville, Illinois. Graduating from the University of Illinois with the A.B. degree in 1884, he continued his studies at Cornell University and received the M.S. degree in 1885. During 1900 and 1901 he was abroad at the University of Berlin and the University of Zurich. Following six years as instructor and professor of general science at Illinois College, 1885–1891, he came to the University of Illinois as professor of applied chemistry, a position which he retained until 1926, when he became professor emeritus. Even after retirement, however, he continued to carry on his researches.

From the beginning Professor Parr was a leader. During his undergraduate days he was an athlete, editor of the student paper, president of the literary society, president of the University Young Men's Christian Association and valedictorian of his class. His versatility may be further appreciated when it is realized that on his return to the teaching staff of the University of Illinois seven years after leaving as a student, he became leader of the Glee Club.

With Professor Arthur W. Palmer he contributed much to the early development of the chemistry department at the University of Illinois. He was always a virile and interesting teacher, and in the early days when the facilities and stimulus for research in the university were lacking, he was always at work developing methods and means of experimentation which not only contributed much to knowledge and technique, but also inspired his students with ambition to accomplish something original.

His scientific discoveries during his forty years of service to the University of Illinois are so numerous that only a few of those for which he was best known need be mentioned. The Parr calorimeter for determining the heat value in coals and other hydrocarbons is used throughout the world. The Parr peroxide bomb is found in the majority of analytical laboratories. More recently he perfected another calorimeter for measuring and recording the heat value of fuel gases. He made an extensive study of alloys and developed one in particular, "Illium," which has powerful acid-resisting properties and which has found wide application for replacing platinum in many types of equipment. His study of boiler waters and their treatment was a very valuable contribution. From the earliest days the study of the physical and chemical properties of coal was one of his prime interests, and the results of his investigations gave him an international reputation in this field. He devised a most valuable "Classification of Coal" and developed a low temperature coking process to a point where it is just a question of time before it will become an important industrial process.

Professor Parr was the author of many articles and bulletins and wrote a well-known text on "The Chemical Examination of Water, Fuel, Flue-Gases and Lubricants." The last few months of his life he devoted his remaining strength to a revision of this book. Professor Parr was associated with many scientific and engineering organizations and technical committees and in each he had much influence. Among the recognitions that came to him were the Presidency of the American Chemical Society, the honorary degrees of doctor of science conferred by Lehigh University and by Illinois College, and the award of the Chandler Medal. Above all he will be remembered best for his genial and kindly person-

ality, his modest and unassuming way which made and held many friends. He was a man of high character and high ideals, an inspiring teacher and an accomplished investigator.

ROGER ADAMS

UNIVERSITY OF ILLINOIS

## MEMORIALS

A FOUNDATION of $100,000, to be known as the Edward C. Pickering Memorial, devoted principally to the study of variable stars by amateur astronomers, has been established at the Harvard Observatory. The funds were advanced by Harvard University, the Rockefeller Foundation, and the American Association of Variable Star Observers. According to the *Harvard Alumni Bulletin*, more than 300 of these amateur astronomers collaborate with the Harvard Observatory; they are scattered throughout the world. In eighteen years the group working as members of the American Association of Variable Star Observers, with headquarters at the Harvard Observatory, has grown from a half-dozen enthusiastic amateurs, guided by Professor Pickering, to more than 100 during his lifetime, and to more than 300 since his death in 1919.

## RECENT DEATHS

DR. HOBART AMORY HARE, professor of therapeutics and diagnosis at Jefferson Medical College, Philadelphia, has died at the age of 68 years.

DR. C. H. KAUFFMAN, emeritus professor of botany and emeritus director of the herbarium of the University of Michigan, died at his home in Ann Arbor on June 14. Professor Kauffman had been ill for sixteen months as the result of a paralytic stroke in February, 1930. He was sixty-two years of age.

DR. SHIBASABURO KITASATO, the distinguished bacteriologist, died in Tokyo on June 13, at the age of seventy-two years. Dr. Kanematsu Sugiura writes that his name has been connected with the following achievements: Isolation of tetanus bacillus and bacillus of symptomatic anthrax in 1889; preparation of diphtheria antitoxin in 1890; discovery of the etiological agent of bubonic plague in 1894; isolation of dysentery bacilli in 1898, and preparation of effective antitoxin for the pneumonic plague in 1911.

# SCIENTIFIC EVENTS

## ISLE ROYALE NATIONAL PARK

THE State of Michigan is proceeding with expedition to the creation of the Isle Royale National Park in Lake Superior, which it hopes will be the twenty-third in the chain of National Parks, according to information received by Secretary Wilbur at the Department of the Interior. The Michigan Legislature has authorized the governor to appoint five commissioners to acquire and hold in trust for later transfer to the Federal Government lands for the proposed park. As soon as this commission is appointed the state will be in a position to acquire the areas needed.

The Congress has authorized the acceptance into national park status of the Shenandoah area in Virginia and the Mammoth Cave in Kentucky on a similar basis. The Michigan area will be number 23 only if it delivers title to the land in question in advance of these two.

The passage of this law by the Michigan Legislature creating a commission marks the first official step toward fulfilment of the requirements of the Act of Congress providing for the establishment of the Isle Royale National Park, approved by the President on March 3, 1931.

According to the authorization of Congress, Isle Royale will become a national park when all the lands of Isle Royale and as many of the numerous surrounding islands as the Secretary of the Interior shall designate shall be turned over to the Federal Government. Following its customary procedure in authorizing the establishment of national parks, Congress specified that no federal appropriations should be made for the purchase of lands for the proposed park.

The Michigan Conservation Commission is directed by the new law to transfer to the park commission more than 2,200 acres of state-owned Isle Royale lands. Many private owners of Isle Royale lands have signified their intention of giving their holdings to the government, and it is expected that more than 50,000 acres of land will soon be held by the Isle Royale National Park Commission for transfer to the government at the proper time.

Isle Royale is the largest island in Lake Superior, having an area of about 135,000 acres. Private holdings amount to nearly 124,000 acres. Adding greatly to its charm and beauty, approximately 100 small islands surround Isle Royale, which is about 45 miles long and shaped like a narrow hand with the fingers toward the northeast.

## OFFICERS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

CHARLES E. SKINNER, assistant director of engineering, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pennsylvania, was elected president of the American Institute of Electrical En-

gineers for the year beginning August 1, 1931, as announced at the annual meeting of the institute held at Asheville, N. C., on June 22, during the annual summer convention of the institute. The other officers elected were: *Vice-presidents,* W. B. Kouwenhoven, Baltimore; W. E. Freeman, Lexington; Paul H. Patton, Omaha; A. W. Copley, San Francisco; L. B. Chubbuck, Hamilton, Ontario; *Directors,* L. W. Chubb, East Pittsburgh; B. D. Hull, Dallas; H. R. Woodrow, Brooklyn; *National Treasurer,* W. I. Slichter, New York (reelected).

These officers, together with the following hold-over officers, will constitute the Board of Directors for the next administrative year, beginning August 1: W. S. Lee (retiring president), Charlotte, N. C.; Harold B. Smith, Princeton, Massachusetts; H. V. Carpenter, Pullman, Washington; G. C. Shaad, Lawrence, Kansas; I. E. Moultrop, Boston; H. P. Charlesworth, New York; T. N. Lacy, Detroit; J. Allen Johnson, Buffalo; A. M. MacCutcheon, Cleveland; A. E. Bettis, Kansas City; J. E. Kearns, Chicago; F. W. Peek, Jr., Pittsfield; C. E. Stephens, New York; A. B. Cooper, Toronto; A. E. Knowlton, and R. H. Tapscott, New York.

The annual report of the Board of Directors, presented at the meeting, showed a total membership on April 30, of 18,334. In addition to three national conventions and five district meetings, 1,628 meetings were held during the year by the local organizations of the institute in the principal cities and educational institutions in the United States, Canada and Mexico.

## AWARD OF THE PRIZES OF THE RESEARCH CORPORATION

THE Research Corporation prizes of $2,500 have been awarded through the Smithsonian Institution to Dr. Andrew Ellicott Douglass, director of Steward Observatory of the University of Arizona, and Dr. Ernst Antevs, of the University of Stockholm. Each will likewise receive the Research Corporation plaque for outstanding contributions to science.

The prize is awarded to Dr. Douglass for his researches on the rings that mark the annual growth of trees which have thrown light on the past climate of the earth and on the correspondence between weather and solar activity. The award to Dr. Antevs was in recognition of his use of varves, layers of clay in ancient lake beds, as time-pieces of glacial activity.

The awards to Drs. Douglass and Antevs are the fourth and fifth of their kind made by the Research Corporation. The first, in 1925, went to Dr. John J. Abel, of the Johns Hopkins University, for his work on ductless glands, animal tissues and fluids. The second, in 1929, went to Dr. Werner Heisenberg, of the University of Leipzig, for his contribution to matrix mechanics and for his exposition of the principle of indeterminance, and the third, also in 1929, to Dr. Bergen Davis, of Columbia University, for the double x-ray spectrometer and other achievements in the field of atomic physics.

The Research Corporation is the only organization of its kind. It sprang from the desire of a scientific man to have the fruit of his scientific labors capitalized for the promotion of research. In 1911, Dr. Frederick G. Cottrell, then chief physical chemist, later director of the U. S. Bureau of Mines, and his associates offered their invention for the electrical precipitation of suspended particles to the Smithsonian Institution, for the benefit of science. As the institution could not well undertake the development of a matter so likely to have commercial and legal complications, Dr. Charles D. Walcott, then secretary of the Smithsonian, undertook with Dr. Cottrell to enlist the aid of public spirited men of New York City to organize a non-profit sharing corporation for the development of the patents, and in 1912 the Research Corporation was formed.

Its purposes are to acquire inventions and patents and make them more available in the arts and industries, while using them as a source of income, and, second, to apply all profits from such use to the advancement of technical and scientific investigation and experimentation through the agency of the Smithsonian Institution and other scientific institutions.

## THE HARVARD DEPARTMENT OF PHYSICS

THE *Harvard Alumni Bulletin* prints information concerning members of the department of physics as follows:

Professor Theodore Lyman is recuperating from a surgical operation for appendicitis, performed on May 10.

Professor William Duane also is convalescing from a serious illness. He will be able during the coming summer, however, to direct research in the x-ray laboratories of the new physics building and at the Huntington Hospital, Boston.

Professor P. W. Bridgman took part in a symposium on the physics of crystals, held at the first annual summer meeting of the American Association for the Advancement of Science, in Pasadena, on June 15. Later in the summer he will be engaged in writing at Randolph, New Hampshire. During his absence from Cambridge, his research on the properties of matter under high pressure will be carried on by his assistants.

After a short vacation in New Hampshire, Professor F. A. Saunders will go on with his research in spectroscopy at the physics laboratory.

Professor Otto Oldenberg will remain in Cambridge during the summer for work in atomic physics.

Professor J. C. Slater, chairman of the department of

physics at the Massachusetts Institute of Technology, and lecturer on physics at Harvard, will give courses in the summer school of the University of California.

Professors E. L. Chaffee and N. H. Black are on leave of absence in Europe. Professor Chaffee is completing his text-book on vacuum tubes, and Professor Black, who has attended courses at the University of Cambridge, will finish his study of the instruction in physics given at the English schools and colleges.

Professor E. C. Kemble will spend the summer in Vermont, writing on quantum mechanics.

Professor F. H. Crawford will take a brief vacation in Virginia and then return to Cambridge and continue his research on band spectra.

J. H. McLeod will teach in the summer school and carry on research in atomic physics; D. S. Muzzey will work on supersonics, F. V. Hunt on architectural acoustics and R. W. Hickman on gas tubes. H. P. Stabler will go to Williams College next year as an instructor in physics.

The remodeling of the Jefferson Physical Laboratory will be completed during the summer, under the direction of H. R. Mimno, instructor in physics, who will also do research on power amplifiers.

### HONORARY DEGREES FOR SCIENTIFIC MEN

AMONG honorary degrees conferred by universities at their recent commencement exercises are the following:

*Yale University:* D.Sc. on Dr. Eugene Lindsay Opie, professor of pathology and director of the department at the University of Pennsylvania, and director of the Henry Phipps Institute, Philadelphia; and on Mr. John Ripley Freeman, civil and mechanical engineer, Providence, Rhode Island.

*Northwestern University:* D.Sc. on Dr. Isaac Abt, member of the medical faculty of Northwestern University since 1894; and on Dr. Robert Bruce Preble, professor of medicine at Northwestern University since 1895.

*The University of Pittsburgh:* D.Sc. on Dr. Carl E. Seashore, professor of psychology and dean of the Graduate School of the State University of Iowa.

*The University of Wisconsin:* D.Sc. on Dr. Irving W. Bailey, professor of plant anatomy at Harvard University.

*Middlebury College:* D.Sc. on Dr. Albert W. Hull, of the General Electric Company.

*Georgetown University:* LL.D. on Dr. Felix Neumann, assistant librarian of the Army Medical Library at Washington, D. C.

*Wilson College:* D.Sc. on Miss Francis Wick, professor of physics at Vassar College.

*Jefferson Medical College:* LL.D. on Dr. Irving S. Cutter, dean, Northwestern University Medical School.

*Earlham College:* LL.D. on Mr. Orville Wright, of Dayton, Ohio, co-inventor of the airplane.

*Brown University:* D.Sc. on Mr. Ambrose Swasey, Cleveland, Ohio.

*University of Toronto:* D.Sc. on Dr. L. V. Redman, vice-president and director of research of the Bakelite Corporation and president-elect of the American Chemical Society.

## SCIENTIFIC NOTES AND NEWS

THE Roosevelt Memorial Association, New York, has awarded a Roosevelt Medal to Dr. C. Hart Merriam, chief of the U. S. Biological Survey from 1885 to 1910, and since research associate of the Smithsonian Institution, who "brought the study of natural history out of the laboratory into the open spaces of field and wood and sky."

PROFESSOR DUGALD C. JACKSON, chairman of the electrical engineering department of the Massachusetts Institute of Technology, was on June 22 presented with the Lamme award for outstanding achievement in engineering teaching, at the annual dinner of the Society for the Promotion of Engineering Education at Purdue University. More than five hundred persons attended the dinner, over which Dr. Harold S. Boardman, president of the University of Maine and president of the society, presided as toastmaster.

*Nature* states that the portrait of Dr. G. Claridge Druce, which was subscribed for by members of the Botanical Society and Exchange Club of the British Isles on the occasion of his eightieth birthday on May 23, 1930, has been painted by Mr. P. A. de Laszlo.

THE gold medal of the Royal College of Surgeons has been conferred on Mr. G. Buckston Browne, in recognition of his contributions to the surgery of the genito-urinary system, and of his gift of an endowment for an institution for surgical research.

DR. LECOMTE DU NOÜY, director of the department of biophysics of the Pasteur Institute, Paris, has been elected corresponding member of the Society of Biology of Vienna.

DR. CARL E. CORRENS, professor of botany at the University of Berlin, has been elected a foreign member of the Linnean Society, London.

M. H. LEBESGUE, professor of mathematics at the Collège de France, and Dr. A. F. Molengraaf, professor of geology at Delft, have been elected associates of the Royal Academy of Belgium.

THE Albert Medal of the Royal Society of Arts for 1931 has been awarded by the council to H. R. H. the

Duke of Connaught, "in grateful appreciation of his presidency of the society since 1911."

MEDALS of the Royal Geographical Society, London, were awarded at the annual meeting on June 20 as follows: The Royal Patrons' Medal was awarded to Rear Admiral Richard E. Byrd for his Antarctic expedition and his flights over the North and South Poles. Captain William Galbraith, naval attache of the American Embassy, received the medal, formally presented by Admiral Sir William Goodenough, on behalf of Admiral Byrd. The Founder's Medal was awarded to Bertram Thomas for his geographical work in Arabia and his successful crossing of the Rub-Al-Khali Desert. The following four grants were presented: The Murchison Grant to L. M. Nesbit for his difficult journey through the Danakil country of Abyssinia; the Back Grant to Colonel R. H. Rowe for his services in Nigeria and on the Gold Coast; the Cuthbert Peek Grant to H. J. L. Beadnell for explorations in the Libyan Desert, and the Gill Memorial Grant to Michael Spender for studies of the Great Barrier Reef of Australia.

AT the anniversary meeting of the Linnean Society of London, held on May 28, the Linnean Gold Medal was awarded to Professor Karl Ritter von Goebel, professor of botany in the University of Munich. Officers of the society were elected as follows: Professor Frederick Ernest Weiss, F.R.S., *president;* Mr. Francis Druce, *treasurer;* Mr. John Ramsbottom, *secretary,* botany, and Lieut.-Colonel John Stephenson, zoology.

AT the eighty-fourth annual meeting of the British Paleontographical Society, held in London on May 29, Dr. F. A. Bather, Mr. Robert S. Herries and Sir A. Smith Woodward were reelected president, treasurer and secretary, respectively.

MR. FRANK O. CLEMENTS, technical director of the research laboratories of the General Motors Corporation, has been elected president of the American Society for Testing Materials.

THE title of emeritus professor of biology has been conferred upon Professor Charles Wright Dodge, for the past forty-one years head of the department of biology in the University of Rochester. Professor Dodge retired from active teaching at the close of the academic year.

DR. HARRIS J. RYAN is retiring as head of the department of electrical engineering at Stanford University in order to devote his whole time to electrical research.

DR. EARL BALDWIN MCKINLEY, formerly director of the School of Tropical Medicine of the University of Porto Rico and member of the medical faculty of Columbia University, has been appointed dean of the George Washington University School of Medicine to succeed Dean William Cline Borden, who becomes professor emeritus of medicine. Dean Borden retired from active service in June, after twenty-two years as dean of the school of medicine. His services in the upbuilding of the medical school were recognized by the university at commencement on June 10 when the honorary degree of doctor of science was conferred on him.

DR. WILLIAM LORENZO MOSS has been appointed professor of preventive medicine and dean of the University of Georgia Medical Department to succeed Dr. William H. Goodrich, effective on July 1.

DR. CARL F. CORI, formerly of the State Institute for the Study of Malignant Diseases, Buffalo, New York, has been appointed professor of pharmacology at the Washington University School of Medicine.

DR. RALPH C. BENEDICT, at present chairman of the department of sciences at Haaren High School, New York City, has accepted the appointment of associate professor of biology at Brooklyn College. He will continue to serve as resident investigator at the Brooklyn Botanic Garden, a position that he has held since 1916.

DR. M. N. SHORT, of the U. S. Geological Survey, has been appointed professor of optical mineralogy in the College of Mines and Engineering of the University of Arizona.

DONALD C. BOUGHTON has been appointed assistant professor of zoology and chairman of the reorganized department of biology at the Milwaukee center of the University of Wisconsin Extension Division. Other appointments in the department are Dr. Benj. H. Schlomovitz, lecturer in physiology, and Dr. Ruth I. Walker, in charge of botany.

DR. E. D. FRIEDMAN, professor of neurology at New York University Medical School, has been promoted to the rank of visiting neurologist at Bellevue Hospital.

MR. E. M. JELLENIK, formerly statistician for the United Fruit Company, has been appointed chief statistician of the Memorial Foundation for Neuro-Endocrine Research, Boston.

DR. JOSEPH M. LOONEY, acting professor of physiological chemistry and toxicology at Jefferson Medical College, has accepted appointment with the Memorial Foundation for Neuro-Endocrine Research as chief of laboratories at the Worcester (Mass.) State Hospital. Dr. Hugh T. Carmichael, of the department of medicine of Union University, Albany, New York, has been appointed resident psychiatrist on the research service of the hospital.

MR. S. H. MCCRORY has been appointed head of the newly organized Bureau of Agricultural Engineering of the U. S. Department of Agriculture, authorized by act of the last Congress. This bureau takes the place of the Division of Agricultural Engineering of the Bureau of Public Roads. Mr. McCrory came to the department twenty-four years ago and for several years has been chief of the division that now becomes a bureau.

DR. ALFRED L. KROEBER, of the University of California, has been appointed visiting professor of anthropology at Columbia University.

DR. CHARLES H. DANFORTH, of Stanford University, has been appointed exchange professor at the Harvard Medical School for the coming year.

DR. W. W. DIMOCK, head of the department of animal pathology at the University of Kentucky, has been called to England as a guest of the British Bloodstock Agency, Ltd., of London, to confer with breeders and scientific men in regard to horse-breeding problems.

DR. ROBERT L. PENDLETON has been granted a year's leave of absence from the post of professor of soil technology and head of the department of soils, at the College of Agriculture of the University of the Philippines, stationed at Los Baños. He has undertaken a soil survey of China, which will involve actual field work in soil mapping, training a staff for the development of the work, etc. The soil survey will be a branch of the National Geological Survey of China, which has its headquarters and laboratories at Peiping.

UNDER the auspices of Yale University, Dr. Hellmut de Terra, formerly of the University of Berlin, now research associate in geology at Yale, will lead a scientific expedition to the Himalayas and western Tibet. The personnel of the expedition will consist of Dr. and Mrs. de Terra, Dr. G. Evelyn Hutchinson, a member of the Yale department of zoology, and George E. Lewis, fellow in vertebrate paleontology. The members of the expedition will start for India in February, 1932, where they expect to spend a year.

JAMES A. G. REHN, secretary and an associate curator of the Philadelphia Academy of Natural Sciences, is now on his way from São Paulo, Brazil, to Descalvados, 1,400 miles north of Rio de Janeiro, to join the Matto Grosso Expedition directed by Captain Vladimir Perfilieff, which already has spent several months in this "campo" country. Mr. Rehn will make a study of the bird, mammal, fish and insect life, and collect specimens for the academy's museum and its scientific collections.

DR. JOSEPH B. NIEDERL and Dr. A. Benedetti-Pichler, of the Department of Chemistry, Washington Square College, New York University, who are spending the summer in Germany and Austria, attended the Hauptversammlung des Vereins Deutscher Chemischer, held at Vienna from May 26 to May 30. Dr. Niederl contributed papers on the quantitative microanalytical estimation of ethyl alcohol in human and animal organs, and on the addition of phenols to double bonds; and Dr. Pichler on experiments, carried out with Professor Alexander O. Gettler, on the isolation of ethyl alcohol from human organs. Dr. R. H. Muller contributed a paper on the application of photoelectric methods in precision colorimetry.

AT the commencement exercises of the Colleges of Medicine and Dentistry and the School of Pharmacy of the University of Illinois on June 13, the commencement address was given by Dr. Edward H. Kraus, dean of the College of Pharmacy, University of Michigan, on "Some Pertinent Aspects of Higher Education." At these exercises, the William Beaumont Prize of $100 for the best research on "Diseases of the Gastro-Intestinal Tract" was awarded to Dr. Alexander J. Nedzel, for work on "The Passage of Bacteria through the Splanchnic Body Surface." The University of Illinois Chapter of Sigma Xi Prize of $25 for the best original piece of scientific investigation by a student during the year was awarded to Morris A. Kaplan, for a report on "A Modified Method for the Preparation of Hematoporphyrin."

THE Committee on Scientific Research of the American Medical Association announces the award of a research grant to Professor Harry J. Deuel, Jr., of the University of Southern California Medical School, for the study of glycogenesis and glycogenolysis in animals after the administration of various sugars; to Dr. Daniel A. McGinty, of the Emory University School of Medicine, for the continuation of studies on the blood in the coronary circulation, and to Dr. W. R. Tweedy, associate professor in the department of physiological chemistry, Loyola University School of Medicine, Chicago, "for further purification of the parathyroid hormone."

THE autumn meeting of the National Academy of Sciences will be held at Yale University on November 16, 17 and 18, 1931. Dr. Yandell Henderson is secretary of the local committee on arrangements.

APPLICATIONS for the position of principal metallurgist must be on file with the U. S. Civil Service Commission at Washington, D. C., not later than July 24. The examination is to fill vacancies in the Bureau of Mines, for duty in Washington, D. C., at Pittsburgh, Pennsylvania, or elsewhere in the field. The entrance salaries range from $5,600 to $6,400 a

year. Competitors will not be required to report for examination at any place, but will be rated on their education, training and experience.

THE Rockefeller Institute has made a grant of $45,000 to Columbia University in aid of research on the common cold. The work is being undertaken at the Columbia-Presbyterian Medical Center by Dr. A. R. Dochez and Dr. Yale Kneeland, Jr., of the College of Physicians and Surgeons.

THE Valentine's Meat Juice Company has made a grant of two thousand dollars a year for a period of three years to the Medical College of Virginia, Richmond, for the purpose of cooperative research in the basic sciences as related to medicine, dentistry, pharmacy and nursing.

AN Associated Press despatch reports that an appropriation of $6,000,000 for an educational campaign on the proper care of the eyes was passed at the national convention of the American Optometric Association meeting in San Antonio. Dr. J. Fred Andreae, of Baltimore, the president, said that the appropriation would be spent in the next four years in newspapers, magazines and other mediums to stimulate interest in the problems of defective vision.

BUILDING has begun on the new monkey house at the Johns Hopkins Medical School for the housing of the rhesus colony of the department of embryology, Carnegie Institution of Washington. Twenty paddocks and six breeding cages together with laboratory space will occupy the roof of the New Hunterian Building at the corner of Wolfe and Madison Streets. Several hundred monkeys may be accommodated under conditions which six years of study in Baltimore and experience at other places have shown are satisfactory for the rhesus monkey.

ACCORDING to *The Museum News* the National Museum in Rio de Janeiro, Brazil, has been reorganized by the new government, with departments of mineralogy and petrography, stratigraphy and paleontology, botany (two sections), zoology (two sections), anthropology, ethnography, and educational work. The director of the museum, Dr. Edgard Roquette-Pinto, reports that during the past year expeditions have been sent out to the Island of Marajo to study Indian pottery, to Maranhao to study the tribes there, to Serra do Mar for botanical study and collecting, and to the valley of the Paraopeba River in Minas for zoological work. Educational work included lectures, motion picture showings, and loans of specimens and slides. Attendance for the year was 114,723.

THE London *Times* states that the Royal research ship *Discovery II* arrived recently at Falmouth from South Georgia, after having been absent from England for about eighteen months on scientific research work in the Antarctic regions. In due course a report will be issued by the committee, of which Mr. E. R. Darnley, of Claygate, Surbiton, is the chairman, and Mr. F. H. Harper, of Putney, the secretary. The *Discovery II* has been engaged on research work on the coast of Graham Island, and has brought home two officers from the marine biological station at South Georgia, Mr. F. D. Omunney and Mr. F. J. Hary. The *Discovery II* was launched in November, 1929, on the Clyde, having been built for the *Discovery* Committee to the order of the Crown Agents for the Colonies.

A new ship, the *Atlantis,* built especially for scientific work at sea, is now on the way to America, but since she will go to work even on her maiden voyage she will not arrive at her destination until about the first of September. The *Atlantis,* built at Copenhagen for the Woods Hole Oceanographic Institution, will reach Woods Hole about September 1. Science Service reports that she is a steel boat of approximately 380 tons displacement, 142 feet long, 29 feet beam and 16 feet extreme draft. She carries a 250 Diesel engine, and can cruise under power alone for 3,000 miles at eight knots; with sail she can extend her radius indefinitely. She carries two laboratories and living accommodations for twelve or sixteen persons. She left Copenhagen for Plymouth, England, a few days ago, and will set sail from the latter port about July 10 for Woods Hole. On the way over she will turn from her course for two north-south profiles across the North Atlantic Drift, one on the longitude of the Azores, the other about fifty degrees west longitude. Another profile will be run off the coast of Nova Scotia. On these scientific runs special attention will be paid to the distribution of the smaller life of the sea in its relation to light penetration into the water and also to the capture of fish that swim at great depths. Chemical studies will also be made of the sea water at stations spaced between Europe and America. The physical studies will be in charge of the commander of the *Atlantis,* C. O. Iselin; the biological work will be conducted under Dr. George L. Clarke, and the chemical researches will be made by Dr. F. Zorell, of the Deutsche Seewarte.

*Nature* says that the issue by the British Association of a catalogue of the objects in the memorial rooms of Down House, Darwin's home at Farnborough, where he lived and worked for almost forty years, will be widely appreciated in view of the approaching centenary meeting of the association in London. Mr. Buxton Browne, the curator and generous donor of Down House to the British Associa-

tion, "to be held in custody for the nation," has restored the memorial rooms as nearly as possible to the state in which they were when Darwin lived there. Much of the furniture is original, and, thanks to the generous assistance of members of the Darwin family and admirers of Darwin, the pictures and other objects and the articles which Darwin had in daily use are here in what was formerly their accustomed place. Among the latest acquisitions are selections from the letters (in facsimile) from Darwin to Fritz Müller, the German naturalist, who was Darwin's correspondent in Brazil between 1865 and 1882. These letters were acquired in 1929 by Professor Henry Fairfield Osborn, of the American Museum of Natural History, New York. Professor A. C. Seward, professor of botany in the University of Cambridge, has recently expressed his intention of placing on loan at Down House the major part of the Darwin Library, which was bequeathed by Sir Francis Darwin to the professor of botany in the university for the time being. The catalogue, which has been prepared by Mr. Buxton Browne and the secretary of the British Association, gives brief historical and descriptive notes on the house and grounds, and is illustrated.

# DISCUSSION

## THE POSITION OF SCIENCE IN SOVIET RUSSIA

I SHOULD like to add my impressions to Professor Cockerell's contribution in a recent number of SCIENCE. During my travels in the Soviet Union for three months last year, it was evident to me that science and the scientific method have assumed an importance in the minds of the Russian leaders second only to communism. In every town that I visited there were new scientific institutes. Small laboratories have been attached to almost every kind of establishment, from the experimental vineyards of the Transcaucasus to the kitchen factories of Moscow.

At the Academy of Sciences in Leningrad I made special inquiry whether research work is encouraged by the Soviet Government. Professor Paul Nikoforoff, the director of the Seismological Institute, who was a member of the staff before the revolution, was emphatic in affirming that research receives the greatest encouragement, and as evidence showed me a number of reprints of recent scientific investigations made by his department. He said that before the revolution the department had a staff of three men, including himself and Prince Galitzin. Last summer the department had a staff of seventy persons, located in twenty-five different stations in the Union. The government is building a 500,000-ruble seismological laboratory on the site of a building belonging to a pre-revolutionary beer baron. "The former wine cellars," he said, "will provide us with excellent constant temperature rooms." At the time of my visit several mechanics were busy in the machine shop with the construction of seismological instruments of a type recently developed by the department.

How is one to reconcile this situation with the reports of the plight of scientific men in the Soviet Union, particularly that of members of the Academy of Sciences? How can it be reconciled with the recent declaration of policy limiting research to the field of applied science?

This is one of the many contradictions which exist in Soviet Russia. For example, why are the Bolshevik leaders so ruthless in dealing with individuals, while at the same time they express sympathy with the lot of the under-dog? Why are they creating new classes, such as the disfranchised groups, while at the same time they profess to aim at a classless society?

In order to explain these and many other contradictions between Russian theory and practice, we must try to look into the minds of the Bolsheviks and to understand their point of view. If we do this we shall find that their principal anxiety is to safeguard the future of the revolution. In their determination not to repeat the mistakes of the French Revolution they are willing to sacrifice anything and everything that they suspect of contributing in the slightest measure to the possibility of counter-revolution. Their ruthlessness toward kulaks, toward private traders and toward engineers and scientists whom they suspect of having capitalistic leanings is due to this anxiety.

Furthermore, the Bolshevik leaders consider their country to be in a state of war, a war against the old order. They take their war even more seriously than we took the World War. If we refresh our memories with regard to some of the things that were done during the World War under the impulse of war psychology, in sending scientists into the trenches, in dealing with people suspected of sympathizing with the enemy, in committing to prison for ten to twenty years people who declared themselves to be opposed to war, we shall gain some inkling of the present psychology of Russian communists.

Another factor that affects the position of science in Russia is the question of *valuta,* that is, foreign

currency to pay for imports. While there I heard complaints from engineers and scientists that they find it difficult to get scientific books and apparatus from abroad. If the government is eager to develop science and to educate engineers, why do they make it difficult to import scientific material? For the same reason that they are placing the people on starvation diet by exporting everything they can put their hands on, while bending all their energies toward the ultimate improvement of the economic condition of the people—namely, in order to make the revolution safe. They are afraid of foreign aggression and are hectically working to industrialize the country before the countries of western Europe are in a position to attack them. In order to secure themselves, through industrialization, against aggression, they sacrifice the present welfare of the people and the progress of science by exporting everything for any price obtainable and importing only the machinery and raw materials which are necessary for their industrial and agricultural program.

The Russian leaders consider the completion of this program to be an absolute necessity. Everything else, however desirable, they place in the category of luxury which they must do without for the present. That is why they are anxious to divert man power and material from pure science, which would be of value to them in the future, to applied science which they need badly now.

It seems to me that in view of the great value of pure science and the slowness with which it can be developed, the policy of expediency adopted by the Bolsheviks is a mistake. But I feel confident that as soon as the present critical situation in Russia becomes easier, science, pure as well as applied, will find in the Soviet government one of its most generous supporters.

H. M. DADOURIAN

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## HORMONES IN CANCER

THE conception that the extension of neoplasms is due to the lack or imbalance in growth-regulating hormones is old. In the past two years we have been engaged in testing the effects of practically all the established hormones and many glandular products, such as the Sokoloff, Watermann and de Kromme, and Coffey-Humber extracts, upon transplantable rat sarcomas and carcinomas. None of these extracts appreciably affected the rate of tumor growth or final mortality as judged by statistical analyses. A possible exception to these findings was a crude extract of the anterior lobe of the hypophysis, which contained a standardized amount of growth hormone, a slight increase in the rate of tumor growth of dosed rats being noted.

We have resorted to irradiating the head of the animal with roentgen rays and implanting radon seeds into the pituitary region in an attempt to stop the activity or destroy this body. Since such a treatment might affect the parathyroids and thyroids by back-scattering, experiments with parathyroid-thyroidectomized animals were also made.

In attempting to destroy the hypophyses the maximum dose of roentgen rays was applied to the rat's head, the body being protected by lead to minimize back-scattering effects. Six series of experiments using twenty to thirty rats per series were performed. With sub-lethal doses of the rays and in a radon series the rate of tumor growth was significantly retarded during the period when the body weight curve remained stationary. Doses insufficient to stop or retard body growth had little effect upon the rate of tumor growth. It has been said that any state which decreases the nutrition of the body as a whole or the tissue in which a tumor is located decreases the rate of growth of the tumor. This objection has been controlled in our experiments by starvation and poisoning by synthalin and heavy metals, both of which retarded body growth without affecting the rate of tumor growth. The experiments with the roentgen ray indicate that the growth factor associated with the pituitary contributes to the regulation of both the rate of body growth and the rate of tumor growth. The experiments with parathyroid-thyroidectomized animals showed that these glands have no demonstrable effect upon tumor growth.

In the experiments with the roentgen ray, radon and the pituitary growth hormone, no effect upon the incidence of tumor takes was noted.

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## HEMOPHILIA[1]

HEMOPHILIA or bleeders disease is a rare disease of the blood, which has a strong hereditary tendency. Only males have the disease, while it is transmitted through the unaffected female. The outstanding symptom of hemophilia is a tendency to excessive hemorrhage. The bleeding may be spontaneous from any part of the body or it may follow a slight injury which would pass unnoticed by a normal individual. It is well known that a strong hemophiliac tendency exists in several of the royal families of Europe. The ill-fated Czarovitch of Russia was a high-grade hemophiliac. The present Crown Prince of Spain also suffers from this disease. In this disease the clotting time of the blood is greatly prolonged.

[1] Presented before the Chicago Society of Internal Medicine, February 23, 1931.

The results of our recent studies in this disease divide themselves into three parts:

(1) We have located a family of hemophiliacs in southern Illinois. Their family records have been traced back 125 years, through six generations. There have been sixteen bleeders in this family, seven of whom are living.

(2) Taking into consideration that only males have the disease, while it is transmitted through the unaffected female, one is forced to the conclusion that if the female can transmit the disease she must potentially have the disease. Then there must be something in the female mechanism which holds the disease in abeyance. The greatest difference between males and females is the sex organs. Working from this hypothesis we treated two high-grade hemophiliacs with ovarian extract, and performed an ovarian transplant on one of them. (The idea of the ovarian transplant was suggested by Dr. H. B. Thomas and he performed the operation.) The boy who received ovarian extract alone has been symptom free for eleven months. The boy who had the ovarian transplant was completely well for five and one half months or until the transplant was absorbed. We concluded from this experiment that in these two patients with hemophilia the introduction of the female sex hormone rendered them symptom free for eleven and five and one half months, respectively. These boys had scarcely ever been free from hemorrhage for a month at a time prior to the institution of this treatment.

(3) In our study of the blood we attempted to find the cause of the prolongation of the clotting time. We found the blood platelets to be very resistant to hypo and hypertonic salt solution. When the resistance of the blood platelets was overcome mechanically the blood clotted in normal time.

We are continuing our study of hemophilia as our experiments are far from complete.

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## GLAUCONITE IN FOSSIL FORAMINIFERAL SHELLS

THIS brief communication has two purposes: (1) to add two more cases from the United States of glauconite occurring in fossil shells of foraminifera; (2) to question the following statement of Twenhofel: "Although there may be some connection between foraminiferal shells and modern glauconites, it is difficult to find any evidence therefor in those of the geologic section."[1]

(1) The writer has been occupied in studying the sediments of the Calvert formation (Miocene) in Maryland. In the field, these sediments show a predominantly light to dark olive-green color. They overlie, unconformably, the highly glauconitic Eocene sands. A laboratory study has revealed the surprising absence of glauconite, except as follows. In Zone 13 (Miocene volume, Maryland Geological Survey), three miles below Chesapeake Beach pier, Calvert County, and at an elevation of 38½ to 45 feet, there occur a number of foraminifera which have in their interiors glauconite. This substance is, in this case, a shiny, dark olive-green; in texture it resembles very fine fish-roe, the individual spheres being quite distinct. The enclosing sediment is a dull, earthy olive-green; no grains of glauconite were seen outside the shells.

In material from the Oligocene Vicksburg group of Mississippi (Brown's Cave, Leaf River), there are numerous foraminiferal shells bearing glauconite in their interiors. Here the color is a somewhat dark peagreen; grains of glauconite are numerous in the enclosing sediment.

(2) In the standard American literature on glauconite, the writer has seen but one specific reference to the occurrence of that substance in fossil foraminiferal shells, and that one is by R. M. Bagg, Jr.[2] In that work no distinction is made between glauconite grains which might have been washed into the shells subsequently and glauconite which obviously formed in the shell itself.

Some material from the Eocene of Chaumont, Paris Basin, furnished me together with that from the Oligocence of Mississippi by Dr. R. E. L. Collins, of Johns Hopkins, shows conclusively that the glauconite now found in the shells had its origin there. Several foraminifera were broken in mounting, and sections of the interior exposed. In all cases the glauconite exactly fits, as a unit, the chamber in which it is found; no sign of finer texture can be seen, in all cases the "unit" of glauconite completely fills the chamber and conforms to all its irregularities. In some cases only several of the innermost chambers are filled and the outer ones show no sign of ever having contained glauconite. It seems impossible to explain such relations by appeal to subsequent filling.

Twenhofel's statement, then, as quoted above, seems unwarranted, since in the Miocene example first described the evidence seems strongly to favor an origin of glauconite in the fossil shells and in the Eocene material from the Paris Basin no doubt can remain that such an origin must be postulated.

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BRYN MAWR COLLEGE

[1] William H. Twenhofel, "Treatise on Sedimentation," p. 340, Baltimore, 1926.

[2] R. M. Bagg, Jr., *Bull.* 88, U. S. Geol. Surv., 1898, p. 13.

# SCIENTIFIC BOOKS

*Opticks or a Treatise of the Reflections, Refractions, Inflections and Colours of Light.* By SIR ISAAC NEWTON, Knt. Whittlesey House, McGraw-Hill Book Company, Inc., New York. $2.50.

THIS book is a reprint of the fourth edition of Newton's "Optics," which was printed in 1730 from a corrected copy of the third edition furnished the bookseller by Newton himself before his death. There are prefixed to the text an enthusiastic foreword by Einstein and a short but clear and valuable introduction by Whittaker, in which the development of Newton's views on optical theory is discussed and some of the analogies between Newton's views and those of modern times are pointed out.

In February, 1672, Newton presented to the Royal Society a paper on a "New Theory about Light and Colours." He begins with the analysis of sunlight by the prism and goes on to show, by a few fundamental experiments, that the different colors of the spectrum have an individuality which they do not lose by any subsequent reflections or refractions, and that white light is a compound of these individual colors. In his treatise on optics, the first edition of which was published in 1704, Newton begins by showing that if the two halves of a card are painted red and blue, respectively, and the card is then viewed through a prism, the refracted images of the two halves will be differently displaced. He then proceeds to the analysis of light from the sun, describing the experiments of his early paper but adding many others, as if he felt that the theory which he had proposed was open to question and needed all the support from experiment which could be given to it. Many of the experiments are well known and are exhibited to all students of the subject; others which are not so frequently shown are of equal interest, and some of them are noticeable for their simplicity and their convincing force. Newton shows that the principal cause for the failure of the telescopes of his day to give distinct images was the dispersion of the light. He proves this very conclusively and then presents his plan for a reflecting telescope and describes instruments which he had made on that plan.

Another set of experiments, even more elaborate than those of the first part, deals with the general phenomena of color. It is shown that colors are not caused by any new modification impressed on the incident light by the material of the body, but that in every case these colors may be analyzed into the simple colors of the spectrum, and that all colors are either those of the homogeneous rays or are compounded from them. In this part of the book he also explains the colors of the rainbow and of natural bodies.

In Book II, we find the study of the reflections, refractions and colors of thin transparent bodies. Newton describes at length the rings that are seen in the light reflected from a thin film of air confined between a sheet of plate glass and the slightly convex face of a lens. He tabulates the successive colors which appear in these rings, when viewed with white light, and studies them also when the light used comes from one part of the spectrum only. In this way he recognizes that there is a certain periodicity exhibited by the light and that the light seems to change its properties at certain equal short intervals of distance so as to be, in one condition, capable of easy reflection and in the other, of easy refraction. These conditions he calls by the name of "fits" of easy reflection and of easy transmission. They are not specified or described in any definite way and no attempt is made to present a model of the light in these fits or to describe its operation. Newton does say that if any one wishes to have a scheme by which he can visualize the action, he can imagine that the rays of light, when they impinge on any surface, may set up vibrations in the refracting or reflecting medium, and that these vibrations are so transmitted as to overtake the rays, and that when a ray is in that part of the vibration which combines with its motion, it easily breaks through a refracting surface, but when it is in that part of the vibration which impedes its motion, it is easily reflected, but he says: "Whether this hypothesis be true or false I do not here consider. I content myself with the bare discovery that the rays of light are by some cause or other alternately disposed to be reflected or refracted for many vicissitudes."

Newton goes on to apply this theory of alternate fits to explain certain colors of thick plates which were first observed by him.

In Book III, Newton gives an account of his experiments on the general subject of diffraction, starting from the original observations of Grimaldi. The experiments are not very numerous or very precise. They convinced him that the action of the body on light which passes near its edge extends for some little distance beyond the material of the body itself. They did not lead him otherwise to any important extension of his views. Apparently his experimental activity ceased before he had carried out the experiments which he had planned in this part of the subject, and he was never able to resume the work. Instead of going on with experiments, he contented him-

self with introducing a number of queries, in some cases suggestive of additional experiments, in others presenting hypotheses as to the nature of light and explanations of the phenomena discovered. Only a few of these queries appeared in the first edition, but their number was increased in the second edition to thirty-one. They are of great interest as showing Newton's mind when it turned to speculation. No one was more adverse to speculation in science than Newton. In the present book he reiterates the *hypotheses non fingo* of the Principia, and yet he could not keep himself entirely from hypotheses. Indeed it is difficult to see how progress can be made in such a science as optics without the help of hypothesis. Yet even in this hypothesis making, Newton's caution is evident.

He supposes that the emission of light results from the vibrations of the parts of the luminous body and that light is seen by vibrations excited in the retina of the eye. He suggests that different rays make vibrations of different bigness and that these excite colors, just as the vibrations in air make sounds of different pitch, and that the most refringent rays make the shortest vibrations. He suggests again that the rays when they fall on the refracting medium may excite waves which overtake the rays of light and thus make the alternate fits which observation discloses. By experiment he proves that heat may be transmitted through vacuum and therefore, he suggests, through a much subtiler medium than air. This medium he thinks is possibly rarer in bodies than it is outside them, and on the supposition that its density increases slightly as the distance from the body increases, he suggests that gravitation may be explained by possible pressures in this medium. He insists, however, that this medium must be of excessive rarity and that a dense medium in which waves could be transmitted, such as is suggested by Huygens, can be of no use for explaining the phenomena of nature and he goes on to say that "as it is of no use and hinders the operation of nature, and makes her languish, so there is no evidence for its existence and therefore it ought to be rejected. And if it be rejected, the hypotheses that light consists in pression or motion, propagated through such a medium, are rejected with it." Earlier in this query he rejects the wave theory on the ground that "if light consisted of pression or motion propagated either in an instant or in time, it would bend into the shadow." From the consideration of the phenomenon of polarized light as discussed by Huygens he concludes that "the rays of light have four sides or quarters, two of which opposite to one another incline the ray to be refracted after the unusual manner, . . . and the other two . . . do not incline it to be otherwise refracted than after the usual manner." This property he thinks is proof positive against a wave theory. In query 29, he presents his corpuscular theory of light. He points out that if the rays of light are very small bodies emitted from shining substances they will travel in straight lines and will be able to preserve their properties unchanged as they pass through various media. They may also be reflected and refracted according to the ordinary laws. To produce the various colors, he suggests that the rays of light may be bodies of different sizes and that they may be put into the fits of easy reflection and easy transmission by stirring up vibrations in the bodies on which they act "which vibrations being swifter than the rays overtake them successively, and agitate them so as by turns to increase and decrease their velocities, and thereby put them into those fits."

In the introduction Professor Whittaker has pointed out that these speculations of Newton present analogies to those which are prevalent at the present day in quantum theory and in wave mechanics. They are of great interest as showing how far an acute mind may go in the speculative interpretation of a body of phenomena without really committing itself to a definite conclusion. What Newton would have thought if he had been shown Young's demonstration of interference and Fresnel and Arago's work on polarized light we can not certainly determine, but it is an interesting subject for speculation.

The book is well printed. In two or three places the long "s" of the original has misled the typesetter into saying that certain intervals "found a common chord," but generally it is remarkably free from error. The publishers should be thanked for this timely issue of a very important book.

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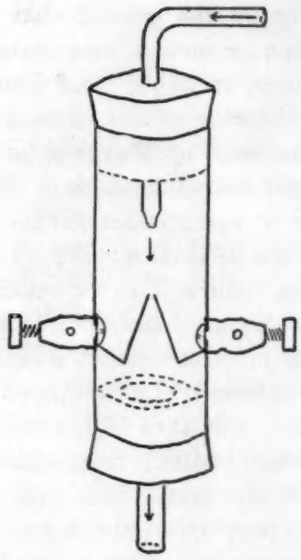
# SCIENTIFIC APPARATUS AND LABORATORY METHODS

## AN ELECTRICAL DROP COUNTER

WHILE making a study of physiological secretions, a drop flow record over an extended period of time was desired. Several different types of apparatus for this purpose were designed, but the one presented here was found to be efficient. Besides its use to record such fluids as urine, saliva, bile, pancreatic and other such secretions, it might be used wherever a record of drop flow is desired over an extended period of time, *e.g.*, slow titrations, evaporation experiments or condensation rates, etc.

A glass tube with inside diameter of about three



centimeters and about eight centimeters long was used. Two holes were blown opposite each other about six centimeters from one end of the tube. Through these holes were placed brass binding posts held in place by a screw from the inside. Small rubber washers were used to prevent breaking the tube on tightening these binding posts. Each screw head carries a length of platinum or non-corroding wire shaped as shown. These contact points are about one millimeter apart.

The top of the tube is stoppered with a rubber stopper carrying the inlet tube of glass, the tip of which is shaped to deliver drops on the contact points. The rubber stopper in the bottom of the tube carries a large bore glass tube funnelled to catch and drain the liquid.

In use the two binding posts are connected across one lead wire of a signal magnet. The writing point of this magnet inscribes a record on a slowly moving surface. If one desires to use this apparatus on such weak electrolytes as urine or tap water it is best to obtain small coil magnets from radio receivers and make special magnets for recording purposes. A voltage supply suitable for such an assembly is a twenty-two and a half volt radio dry cell, although we have found line voltages of ten and twelve as used in our laboratories of sufficient strength.

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## PAPER APRON TO PREVENT CURLING OF MICROTOME SECTIONS

A VERY simple process, far more difficult to describe than to perform, of using a small wet paper on a paraffine or celloidin block will prevent curling.

A piece of wet tissue paper narrower than the knifeward edge of the block and longer, so it will overlap the side away from the blade, is placed on the paraffine or celloidin block. Capillarity will hold the paper in place. The paper should not overlap the knifeward edge or the blade will slide over all. The cut section with the paper will rest flat on the knife with the overlapped edge in such position that the paper, with section adhering, can be easily removed with forceps or scalpel and placed on a wet slide, where the section can be oriented, and the paper, with a backward bend of the overlapped edge, removed, leaving the section in place. With a little practice this will become easy. Though unruly sections are very infrequent it is desirable to leave a wider margin of paraffine on sections by not trimming block as close as usual. This gives an area where a needle or scalpel point can be inserted to wedge off the few unruly sections that do occur. I find it desirable on a Thoma Jung to flip the paper and section into my hand with the edge of a scalpel or pair of forceps, as the edge of section adheres to edge of knife.

This process works more easily with a sliding microtome than with a rotary, though it will work with either. Obviously, ribbons can not be cut in this manner, and the process is much slower, but sections, either paraffine or celloidin, are obtained uncurled. A sharp blade is just as necessary with this method. Using woody apple buds I have obtained excellent five micron sections and good three micron sections on a Thoma Jung.

I am indebted to Dr. E. J. Schreiner, research forester of the Oxford Paper Co., who told me that for unembedded wood he used wet slips of paper, one to each section, to prevent curling, and later floated off the paper. Because paraffine sections will not spread properly with the paper adhering, I find it necessary to remove paper before heating slide. Whether the process is new or not we do not know. Lee, "Vade Mecum," does not mention it, and we have never heard of its being used elsewhere.

Let me add that for sections that tear readily, not being well embedded, I can not recommend too highly the "collodionisation" method suggested in Lee, "Vade Mecum." Merely paint surface of block with very thin celloidin, allow a second or two to dry, place on wet paper and cut. Spread with heat as usual. After drying, before placing slide in xylol, I find it desirable to remove celloidin surface by first immersing a minute in ether-alcohol.

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# SPECIAL ARTICLES

## THE AGGLUTINATING ACTION OF AGAR ON BACTERIA

THE recent statement by C. P. Fitch and associates[1] that small amounts of agar have some influence on thermo-agglutination of the *Brucella abortus* group leads me to state briefly some facts in reference to the same or a similar phenomenon not associated with heat which was first observed a dozen years ago in the study of *Brucella abortus*. Though the phenomenon may be well known, the writer has not seen any reference to it until the appearance of the article cited. Examination of recent hand-books, such as the "System of Bacteriology" by English authors and the latest edition of the German hand-book by Kolle, Kraus and Uhlenhuth, has not revealed any statement bearing on this property of a universally used culture material.

The custom of having a small amount of condensation water left in the sloped agar tube brought this phenomenon to the surface. When growth from the agar surface is suspended in water, normal saline or bouillon, *Brucella abortus* exhibits active Brownian motion. When the same growth is suspended in a small drop of condensation water from the same or a sterile agar tube, the clumping is so prompt that all bacteria appear in dense cloudlike masses no matter how quickly the slide is placed under the microscope. At first the clumping was referred to specific agglutinins in animal tissues placed in the tube but soon found to be inherent in the agar itself. The clumping persists in the condensation water of a culture medium consisting of 2 per cent. agar only. Acid agglutination was eliminated, inasmuch as the clumping took place in a neutral medium. It does not occur among bacteria from the sloped agar surface itself when they are suspended in bouillon, normal saline or water.

If the original condensation water formed after the agar tubes have been sloped and then placed upright be removed and replaced by either bouillon, normal saline or water, the added fluids acquire within a few days clumping properties. A second replacement acts in the same way. Even when enough fresh fluid is added to the upright tube to cover most of the slope, the fluid acquires clumping properties. This removal and replacement was carried out four successive times by covering the agar surface each time with the fresh fluid. The water clumped after the second exhaustion completely, only partially after the third, and not after the fourth. The clumping agent is present in the water in which agar shreds are allowed to swell up. After repeated washings of the shreds over night the fluid failed to clump. Made into ordinary nutrient agar, the condensation water which formed again clumped, but the clumps were small as compared with the large cloudlike masses of the usual supply. Allowed to stand for several weeks, the agar tubes made with washed agar failed to clump. When a thin film of bouillon was allowed to rest on the entire slope, the clumping reappeared next day. Boiling and resloping brought clumping back promptly, however.

Spontaneous agglutination was first observed among members of the non-motile Brucella group and was at first regarded specific for that group. All races acted alike. Another species similarly affected is the motile paratyphoid bacillus, including many races thus far examined. A strain from the surface of an agar growth when stirred in condensation water becomes clumped, but not wholly. About one third of the rods remain single and in motion. The rest are in clumps in which the rods are ranged side by side. These bundles measure up to 10 μ in breadth. Since the bacilli in young cultures are all in active motion the clumping is not selective with reference to motility. Clumping has also been observed in certain strains of staphylococci, streptococci, *B. pullorum* and *B. bronchisepticus*. There are indications that capsulated bacteria, not clumped themselves by such capsular material, are not affected by the agar agent. The concentration of the agglutinating substance in the condensation water varies with the time of exposure of the agar mass to it. Clumping was still present in dilutions of 1 to 8 in many observations.

It would require more space than this communication is entitled to to go into further details or to try to correlate our observations with those presented by Fitch and associates. Further analysis of the phenomenon has been under way.

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[1] *Tech. Bul.* 73, 47, Univ. Minn. Agri. Exp. Sta., 1930.

## INTELLIGENCE AND BODY CHEMISTRY[1]

IN a recent communication to SCIENCE,[2] H. D. Powers reports a series of observations of the calcium and the inorganic phosphorus of the blood in idiots and in normal or superior persons. The writer has certain data bearing on this point to which he desires to call attention. These include material which has not previously been published because the essentially negative nature of the results indicated the need for further work.

The data presented below were obtained from a random sample of children referred to the Illinois

[1] Publications of the Institute for Juvenile Research; Paul L. Schroeder, M.D., Director. Series B—No. 175.
[2] H. D. Powers, SCIENCE, 73, 316, 1931.

Institute for Juvenile Research, being limited only by the technician's ability to obtain from the patient a sufficiently large sample of blood. They included intelligence levels ranging from the imbecile to the superior. Calcium of the blood was determined by the Clark-Collip modification of the Kramer-Tisdale method; inorganic phosphorus by the Fiske-Subarrow method, and total and lipoid phosphorus by similar procedure following digestion and alcohol-ether extraction, respectively. The intelligence quotient was obtained in each case by an individual mental test.

The coefficients of correlation obtained between the I.Q.'s and the chemical determinations are given below, together with the number of cases upon which each is based (in parenthesis).

| | Correlation with I.Q. |
|---|---|
| Calcium | +.06 (69) |
| Inorganic Phosphorus | +.07 (245) |
| Lipoid Phosphorus | −.04 (77) |
| Total Phosphorus | +.06 (118) |
| Lipoid P ÷ Total P | +.19 (63) |

Our results agree with those of Powers with respect to the calcium of the blood. There is no evidence that it bears any relation to the individual's intelligence.

With respect to the inorganic phosphorus of the blood, on the other hand, we differ markedly from Powers. The data obtained from 245 subjects show no relationship between intelligence, as measured by the I.Q., and the phosphorus content of the blood. There is, of course, a difference in method. We worked with persons *ranging from* subnormal to superior intelligence, instead of extreme groups, and did not include cases of idiocy. If, however, the difference obtained in such extreme groups is valid outside of the very lowest ranges of intelligence, a correlation will necessarily be apparent when a wide range of intelligence is considered. Although our subjects were children, age does not appear to be a factor, for we have found that it correlates with the inorganic phosphorus content of the blood only to the extent of −.14. Moreover, the determinations of lipoid and of total phosphorus show no higher relationships to intelligence than do those for inorganic phosphorus. The ratio of lipoid phosphorus to total phosphorus does, indeed, correlate more highly with intelligence, but, as this relation is vitiated by a correlation of +.30 between this ratio and chronological age, further work with controlled age groups is essential for its interpretation.

The relationship of phosphorus metabolism to mental phenomena is a problem which is as yet far from solution. We have noted elsewhere[3] a correlation of −.51 between intelligence and the excretion of phosphorus per unit of body weight. As the significance of this figure is lessened by the fact that it was obtained from only 28 subjects, it was suggested that verification was most desirable. This definitely positive result from a study of urinary excretion, the negative results mentioned above, and Powers' positive findings, taken together, suggest a complexity of relationship that urgently calls for further work. Our interest has been primarily in connection with certain non-intellectual traits, with which both the calcium and the various types of phosphorus in the blood likewise failed to show any significant correlations.

In his first paragraph, Powers makes reference to the lack of previous work on the relationships of body chemistry to mental phenomena, and characterizes the work that has been done as "vague." This broad statement can not be allowed to pass unchallenged. For example, the literature contains a group of studies, too numerous to mention in detail here, on the differential chemistry of the psychoses and neuroses.[4] In general, the procedures have been similar to that of Powers, save that psychotics or neurotics, instead of idiots, were compared to normals. Many of these studies have yielded negative results and they have often contradicted one another, but they have hardly been "vague." Such work as that of Starr[5] and Stratton[6] on stammerers likewise reached definite conclusions, and the writer[7] has published correlational values. One fears that Powers has been somewhat overhasty in drawing his indictment, for he has himself published nothing more definite than can be found elsewhere.

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[3] G. J. Rich, *Jour. Abnorm. and Social Psychol.*, 23: 172, 1928.

[4] Reviews of the earlier of these papers may be found in: A. Schaefer, *Monatschr. f. Psychiat.*, 2: 157–162, 229–242, 377–386, 443–451, 1897; F. M. Barnes, *Amer. Jour. Insanity*, 68: 431–472, 1912; and K. M. Bowman, *Amer. Jour. Psychiat.*, 2: 379–408, 1923.

[5] H. E. Starr, *Amer. Jour. Psychol.*, 33: 394–418, 1922.

[6] L. D. Stratton, *Jour. Compar. Psychol.*, 4: 325–346, 1924.

[7] G. J. Rich, *Jour. Abnorm. and Social Psychol.*, 23: 158–175, 1928; *Arch. Neurol. and Psychiat.*, 20: 589–594, 1928.

## BOOKS RECEIVED

*Anales de la Dirección de Meteorologia.* Tomo XIX: Conteniendo las observaciones practicadas en al año 1928. Volumen I: Resultados de las Observaciones Aerológicas Efectuadas con Globos-Pilotos en el Observatorio Regional Buenos Aires. Ministerio de Agricultura de la Nacion, Buenos Aires.

*Boletim do Museu Nacional.* Volume VI; No. 2. Pp. 61 + 147; No. 3. Pp. 149 + 264; No. 4. Pp. 265–320. Illustrated. The Museum, Rio de Janeiro.

SPEERSCHNEIDER, C. I. *The State of Ice in the Arctic Seas: 1930.* Pp. 17. Danish Meteorological Institute.